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APPEAL BRIEF

2763

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Scott H. Hutchinson and Gregory M. Hanka	§	Docket No. 23946
Serial No: 09/233,860	§	Group Art Unit: 2763
Filing Date: January 20, 1999	§	
Title: SOFTWARE-IMPLEMENTED METHOD FOR IDENTIFYING NODES ON A NETWORK	§	Examiner: William D. Thomson (703) 305-0022

#12
10-18-00

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Dear Sir:

Enclosed are the following:

1. Appeal Brief, THREE (3) copies required under 37 CFR 1.192(a) containing Exhibits A and B;
2. Check in the amount of $310.00 required by 37 CFR 1.136(a) ; and
3. Postal Receipt Card.

It is believed that no additional fees are due. However, the Commissioner is hereby authorized to deposit any overpayment or charge any other fees which may be required by this paper, to Winstead Sechrest & Minick P.C. Deposit Account No. 23-2426.

Very truly yours,

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Hugh R. Kress

Hugh R. Kress, Reg. No. 36,574

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1159:23946-P001US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:
Scott H. Hutchinson and
Gregory M. Hanka

For: SOFTWARE-IMPLEMENTED METHOD FOR IDENTIFYING NODES ON A NETWORK

Atty Dkt: 23946-P001US

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Deborah Rypacek
Printed Name

Assistant Commissioner for Patents
Washington, DC 20231

APPEAL BRIEF

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I. INTRODUCTION

This is an appeal to the Board of Patent Appeals and Interferences of the rejection of claims 1-3, 5-8, 9-13, and 15-24 in a "final" Office Action dated May 10, 2000 ("the Office Action") in application S.N. 09/233,860 ("the '860 application"). A Notice of Appeal was submitted on August 3, 2000 and received by the Patent & Trademark Office on August 7, 2000, such that the deadline for submission of this Appeal Brief is October 7, 2000. The requisite fee payment pursuant to 37 C.F.R. §§ 1.192 and 1.17(c) is enclosed. However, if the fee payment is missing or insufficient in amount, or if any other fees are determined to be due (such as for extending the time for submission of this Appeal Brief), the Commissioner or Assistant Commissioner is authorized to charge any deficiencies to Winstead Sechrest & Minick Deposit Acct. No. 23-2426/23946-P001US.

A. Real Party in Interest

The real party in interest in this Appeal is BindView Development Corporation, a Texas corporation having a place of business at 5151 San Felipe, Suite 2100, Houston, Texas 77056, by virtue of an assignment of the application dated January 20, 1999 and recorded at Reel 9726, Frame 0990.

B. Related Appeals and Interferences

None.

C. Status of Claims

Claims 1-3, 5-8, 9-13, and 15-24 are pending. Claims 1-3, 5-8, 9-13, and 15-23 have been twice rejected; claim 24, added in an Amendment submitted subsequent to a first Office Action, has been once rejected. Pursuant to 37 C.F.R. § 1.192(c)(9), the claims involved in this appeal are reproduced in Appendix A.

D. Status of Amendments

There are no pending, unentered amendments.

E. Summary of the Invention

The invention disclosed and claimed in the '860 application is directed to a method and apparatus for asset tracking and management in a computer network. As noted in the specification of the '860 application ("the Specification"), the term "asset management" refers to the process of "track[ing] computers and similar equipment ('nodes'), and their components, on computer networks." (Specification, p. 2, lines 16-18). As will be discussed below, this process is to be distinguished from network management, a term which is known to those of ordinary skill in the art to involve the management of a network's logical topology, constituency, and performance.

The invention disclosed and claimed in the '860 application involves the detection of one or more "unique attribute values" of a client node (i.e., one of the hardware components such as a computer workstation) attached to the network, and the communication of such unique attribute values to a central server program. *See, e.g.,* Specification p. 4, lines 14-16. In accordance with the disclosed invention, "[t]he one or more unique attribute values are also stored to a local database at the client node." (*Id.*, p. 4, lines 18-19).

In one disclosed embodiment of the invention, a specific attribute value tracked by the asset management software is the current address of the node's network interface card ("NIC"), along with a former NIC address held by the node, if any. (*Id.*, p. 4, lines 26-29). At the same time, it is noted in the Specification that, without the benefit of the teachings of the Specification, NIC addresses are imperfect attributes to be used for the purposes of asset management, owing to their relatively transient nature in the context of most practical applications. As noted in the Specification, "[a] NIC... is often not a permanent part of a microcomputer's motherboard...; very often it is a removable component [such that] any asset management product relying solely on the NIC address for node identification will falter when a node's NIC... changes.... By analogy, the FBI would have

a similar problem if a person's fingerprints were to change every time the person got a manicure." (Specification, p. 8, lines 3-13).

A feature of the subject invention noted in the Specification relates to the ability of an asset management system in accordance with the invention to reliably identify the particular client nodes making up or coupled to the network despite the fallacies of nearly all metrics for tracking hardware components. Table 1, appearing on page 10 of the Specification, summarizes the various available metrics and identifies each one's shortcomings. The Specification notes with reference to Table 1 that at present, the least fallible metric for component tracking is a fledgling motherboard serial number standard that has yet to gain widespread industry acceptance. (*See*, Specification, p. 6, lines 7-25).

The disclosed invention, therefore, involves a system whereby the efficacy of tracking a network node's NIC address is substantially augmented through the introduction of a protocol which accounts for unpredictable and otherwise untraceable changes in a component's NIC address. Through application of the teachings of the subject invention, effective asset management can be realized notwithstanding the shortcomings of prior art techniques.

F. Issues

(a) Are claims 11 and 12 indefinite within the provisions of the fourth paragraph of 35 U.S.C. § 112 because they fail to further limit the claims from which they depend?

Assignee answers "no."

(b) Are claims 11 and 12 indefinite within the provisions of the second paragraph of 35 U.S.C. § 112 for failing to particularly point out and distinctly claim the subject matter which Applicant (Assignee) regards as the invention?

Assignee answers "no."

(c) Are claims 1-3, 5-8, 9-13, and 15-24 properly rejected under 35 U.S.C. § 102 because they are anticipated by the cited prior art?

Assignee answers "no."

G. Grouping of Claims

Assignee argues hereinbelow the patentability of the claims under the following groupings according to the patentability issues presented.

35 U.S.C. § 112 ¶ 2: Claims 11-12.

35 U.S.C. § 112 ¶ 4: Claims 11-12.

35 U.S.C. § 102: Claims 1-3, 5-8, 9-13, and 15-24.

H. Argument

1. 35 U.S.C. § 112 ¶ 2: Claims 11-12

Claims 11 and 12 stand rejected under 35 U.S.C. § 112, second paragraph. For convenience of reference, exemplary claim 11 is reproduced here:

> 11. A program storage device readable by a processor in the client node of a specified one of claims 1 through 3, 5 through 7, and 21 through 24, and encoding a program of instructions including instructions for performing the operations recited in the specified claim as being performed by the client node.

(Amendment B, submitted February 14, 2000).

Because of this claim's dependance from claim 1 (*inter alia*), claim 1 is likewise reproduced here for convenience of reference:

> 1. A method, executed by a node on a network, said node comprising at least one asset, of transmitting asset-management information about the node, the method comprising:
> (a) determining a current address value of a network interface card of the node, referred to as a NIC address value;
> (b) retrieving, from a data storage at the node, a former NIC address value for the node; and
> (c) transmitting asset-management information concerning the node together with the current NIC address value and the former NIC address value.

Id.

According to the Office Action, "[claims 11 and 12] are written in a manner that does not distinguish them as either method or computer readable medium, but rather some type of hybrid wherein the computer readable medium cannot be clearly correlated to specific method steps." This assertion is respectfully traversed.

As a preliminary observation, it is to be noted that the propriety of claim formulations such as adopted by claims 11 and 12 is well established and has much precedent under U.S. patent law. Although the argument has been previously raised earlier in the prosecution of the present application (in an "Amendment B, Response to November 12, 1999 Office Action and Summary of Telephone Interview" submitted February 14, 2000), it bears worth repeating in this forum: the Court of Appeals for the Federal Circuit has approved at least one claim in the same basic format as that of claims 11 and 12 at issue here. In *In re Warmerdam*, 33 F.3d 1354 (Fed. Cir. 1994), the Federal Circuit reversed an indefiniteness rejection, noting that "[t]here is no requirement that a claim for a machine which incorporates process steps... must conform to the conventional definition of a product-by-process claim," holding that "[t]here has been no showing that one skilled in the art would have any particular difficulty in determining" the scope of the claim in question. *Id.*

With regard to the claims at issue in this appeal, there is a similar lack of indefiniteness. Claim 11 refers to a "program storage device," for example, a computer disk, and specifies only that the device "encod[es] a program of instructions for performing the operations recited" in certain method claims. It is respectfully submitted that such a claim formulation gives rise to no indefiniteness. Claims 11 and 12 are arguably nothing more than multiple-dependent claims;[1] the Office Action itself notes that "the applicant has been assessed a surcharge for this type of multiple dependent claim language." (Office Action, p. 5).

Consideration of an isolated sub-part of claim 11 is illustrative of the lack of indefiniteness: As applied to claim 1, claim 11 recites as follows:

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[1] It is not clear to the Assignee that claims 11 and 12 are multiple-dependent claims. Arguably, claims 11 and 12 are Markush-type claims. However, the specific label applied to claims 11 and 12 is immaterial to the substance of the arguments advanced herein.

> "A program storage device readable by a processor in the client node of ... claim 1... encoding a program of instructions including instructions for performing the [following] operations: (a) determining a current ... NIC address value; (b) retrieving, from a data storage at the node, a former NIC address value for the node; and (c) transmitting the current NIC address value and the former NIC address value."

Pared to its essentials, it is entirely clear what is claimed:"A program storage device readable by a processor in the client node of claim 1" (a simple dependent claim) "encoding a program of instructions... for performing" specified operations. The multiple-dependent nature of claim 11 gives rise only to other equally definite claims, a privilege for which the Assignee has already paid. It is thus submitted that nothing about the resultant claim language is in any way indefinite. That claim 11 claims as alternatives the incorporation of other method claims renders claim 11 nothing more or less than a multiple dependent claim, the propriety of which being well established. Hence, there is no justification for the Office Action's assertions that "claim 11 cannot be examined, allowed, or rejected in total." Examination of claims 11 and 12 is no more "difficult if not impossible," as the Office Action alleges (Office Action, pp. 5 & 6), than any other multiple-dependent claim.

The Assignee further notes that the formulation of claims 11 and 12 is undeniably precedented. A search of the U.S. Patent & Trademark Office's Internet web site (www.uspto.gov) has uncovered more than 500 issued patents having comparable claim formulations.[2]

2. 35 U.S.C. § 112 ¶ 4: Claims 11-12

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[2] Using the Boolean search terms "program storage device" and "tangibly embodying" in the claim language of all U.S. patents issued since 1976, more than 500 patents were identified. A listing of the search results is attached as Exhibit B. Among those patents listed in Exhibit B is U.S. Patent No. 5,860,929 to Rubin et al., which includes a claim exemplary of those at issue here; a copy of the '929 patent is attached as Exhibit C. Claim 11 of the '929 patent recites in its entirety: "[a] program storage device readable by a processor in an ultrasound machine, tangibly embodying a program of instructions executable by the processor to perform the method of a specified one of claims 1 through 3." It is submitted that such language is indistinguishable from that of the claims at issue herein.

The Office Action's assertion that claims 11 and 12 are invalid under paragraph 4 of 35 U.S.C. § 112 is simply not understood and, accordingly, respectfully traversed. Claims 11 and 12 are, distilled to their substance, directed to "program storage devices," whereas the respective claims from which they depend are directed to "a method ... of transmitting [or recording] asset-management information concerning [a network node]." Given that the claims from which claims 11 and 12 depend recite methods, whereas claims 11 and 12 recite "program storage device[s]" (e.g., hard disk drives, diskettes, and the like), the Office Action's assertion that claims 11 and 12 "imply the same scope relative to the claims to which each depends" finds no basis in fact.

As has been noted in prior submissions relating to the present application, claims 11 and 12 are designed to read upon the physical media upon which certain program instructions may be stored, as distinctly contrasted with the method implemented by such instructions. It is inarguably improper to assert that there is identity between the physical embodiment (a computer disk, e.g.,) and an intangible methodology. Not only do claims 11 and 12 "further limit" the claims from which they depend, they wholly transform those claims into new scopes of coverage.

3. 35 U.S.C. § 102: Claims 1-3, 5-8, 10-13, 15-16, and 18-24

In the Office Action, claims 1-3, 5-8, 10-13, 15-16, and 18-24 were rejected under 35 U.S.C. § 102 as being unpatentable over U.S. Patent No. 5,878,420 to de la Salle ("*de la Salle*") and U.S. Patent No. 5,923,850 to Barroux ("*Barroux*").[3]

The patentable distinctions between the invention disclosed and claimed in the present application from *de la Salle* and *Barroux* shall be separately discussed below. There is at least one feature common to both references, however, that merits preliminary notice. In particular,

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[3] The *de la Salle* and *Barroux* references were not cited in the first Office Action (dated November 12, 1999) in connection with the subject application. Claim 24, added only after issuance of the first Office Action, falls clearly within the scope of the disclosure and claims of the application as originally filed. Hence, it is not clear to the Assignee the basis for the Office Action's statement that "Applicant's amendment necessitated the new ground(s) of rejection presented...." Likewise, the basis for the designation of "finality" of the (second) Office Action is not understood.

the Assignee submits that both of the cited references assume away the very essence of the problem to which the present invention is directed.

As noted above, the present invention is directed to an asset management system for a computer network. A key feature of the invention is the ability of the system to uniquely identify each node on the network. As noted in the specification, "[t]here does not yet [at least at the time of filing the '860 application] exist a standard, ubiquitous 'fingerprint' for computers... so asset management products must approximate one using whatever shifting data they can find on each node." (Specification, p. 6, lines 3-5). The Specification discusses in detail various attributes of network nodes which might be considered useful for the purposes of uniquely identifying them, and as summarized in Table 1 on page 10, concludes that only one attribute -- one that has not found widespread acceptance among computer equipment manufacturers -- was not susceptible to failure as a node identifier.

In the cited references, on the other hand, the existence of unique identifiers for network nodes is not discussed; rather, it is assumed. That is, as shall be discussed in greater detail below, the cited references completely ignore the problem sought to be solved by the present invention, and indeed take as their respective fundamental premises that such a problem does not exist. As a result, each cited reference fails to teach or suggest critical elements of the claimed invention.

(a) U.S. Patent No. 5,878,420 to de la Salle

The very title of *de la Salle* -- "Network Monitoring and Management System" (emphasis added) -- reveals that this reference is not directed to the problem sought to be solved by the present invention, namely asset monitoring and management. *de la Salle* asserts that "a primary task [of a network management system] is to keep track of the actual configuration of the network and, following that, to reconfigure or otherwise optimize or 'tune' the network, as necessary, so as to minimize problems and maximize the utilization of resources." *de la Salle*, col. 1, lines 58-63. That is to say, *de la Salle* is concerned only with the configuration and topology of a network

comprising a plurality of interconnected components, rather than with the identity of specific hardware components making up the network. While *de la Salle* seeks to obtain and track information useful for the purposes of enhancing and maximizing overall network performance, the present invention seeks to obtain and track information useful for the purposes of asset management.

Because *de la Salle*'s objectives are entirely different than those promoted through the practice of the present invention, *de la Salle* is unconcerned with the very problem sought to be solved by the present invention. It is clear that *de la Salle* regards a network component's NIC address (*de la Salle* uses the term "board address") as a sufficiently unique identifier. *de la Salle* observes that "[o]rdinarily, each network component 16 will have a single network address which is used by the system in order to locate that particular component 16." *de la Salle*, col. 5, lines 33-36. Further, *de al Salle* notes that "[t]he board address 36 is the typical information which is utilized within the network to identify and locate (logically) the particular network component 16." *de la Salle*, col. 5, lines 46-48.

Notably, the present invention specifically identifies the disadvantages of using merely a network address as a node identifier for the purposes of asset management: "The NIC 107, however, is often not a permanent part of a microcomputer's motherboard 108; very often it is a removable component plugged into the motherboard.... [T]hus any asset management product relying solely on the NIC address for node identification will falter when a node's NIC 107 changes in this way." Specification, p. 8, lines 3-11.

de la Salle's exclusive reliance upon each network components "board address" as a unique identifier is further evident from its proposed treatment of network components having no board address (such as bridges), or multiple board addresses (such as routers). *de la Salle*'s discussion of these special cases is highly revealing of *de la Salle*'s exclusive interest in mapping network topology and configuration, as contrasted with the present invention's concern with identification of specific hardware assets.

In the former case, *de la Salle* notes as follows with respect to network components having no network address:

> The next process step is in the nature of a resolve bridged stations conflict step 122. This occurs when stations (identical board addresses 36) are detected on different branches of the network 16. When this occurs, it may be ***assumed*** that the branches 14 are connected by a bridge 28, which (as discussed above) is transparent to the packets 22, since bridges 28 are not assigned network addresses 23 and will not have individual board addresses 36. A heuristic analysis is utilized to '***guess***' the identity of a branch 14 upon which the station is actually located, and a location is assigned as a result of this guess."

de la Salle, col. 11, lines 34-44 (emphasis added)

Again, it is clear that *de la Salle* is wholly reliant upon "board addresses" to be as close to a "unique identifier" of a network component as any available characteristic or parameter. Nonetheless, *de la Salle* must resort to "guessing" in the event that a board address proves unreliable for this purpose -- an unreliability that the present application notes to be inherent. Indeed, were a truly unique identifier such as is obtainable through the practice of the present invention contemplated by and available to *de la Salle*, no such "guessing" would be necessary.

With regard to the latter case of network components having more than one "board address," *de la Salle* states as follows:

> Since routers 30 will have different addresses (both network and board) for each branch 14 to which they are connected, a true picture of the overall network must include some method of resolving these multiple address locations into a single station. For this purpose, a consolidate routers: Phase 1 step 124 and a consolidate routers: Phase 2 step 126 are included in the db builder routine 96. The phase 1 step 124 invokes reasoning based on the standard router query under the SNMP (Simple Network Management Protocol). This involves address analysis in which a single location appears to 'own' and advertise overlapping addresses on different branches. When this occurs, it is ***a relatively safe assumption*** that the station is a single station component 16 and that it is a router 30. The phase 2 step 126 includes hop count analysis to ***postulate*** router identity."

de la Salle, col. 11, lines 45-59 (emphasis added).

Yet again, it is evident that *de la Salle* regards board addresses as the most reliable distinguishing characteristic of any given network component, and yet again, *de la Salle* proposes nothing more effective than "assumption" and "postulation" to overcome the fallacies of

board addresses serving as unique identifies. Applying the teachings of the present application, on the other hand, no such imprecise methods would be necessary.

A further critical deficiency of *de la Salle* relates to its failure to teach or suggest the concept of associating time or date stamps with information obtained from network nodes. It is respectfully submitted that introducing this additional temporal dimension to a node identifier is one of the features of the present invention which sets the invention patentably apart from the prior art, including *de la Salle*. Nowhere does *de la Salle* teach or suggest associating time or date data with the network analysis data it describes. On the contrary, *de la Salle* seems to contemplate completely eliminating the temporal dimension from its network data, and calls for a system in which "the sampling assembly will be continuously providing new probe objects 52 and the analysis assembly will continually enhance and update the database 99, the database management 138 will continually provide fresh and current information on the precise state of the network 12." *de la Salle*, col. 14, lines 42-46.

In fact, *de la Salle* appears to require continuous operation in order to effectively accomplish its objective of monitoring a network's configuration and topology. If the *de la Salle* system were deactivated for any appreciable amount of time (i.e., sufficient for any changes in network topology or configuration to take place), the *de la Salle* system would have to in essence be re-initialized (not *de la Salle*'s terminology), in which case changes in hardware such as are detectable using the system of the present invention would be overlooked. *de la Salle* notes that "[i]n initial operation, the system 10 will require a period of time to sample sufficient data in order to build a working database." *de la Salle*, col. 14, lines 29-31. Thereafter, *de la Salle* contemplates the continuous operation noted above. Because *de la Salle* eliminates any temporal component from the data it collects, its proposed system cannot accomplish either its own contemplated objectives (network monitoring) or those contemplated by the present invention (asset monitoring) unless it operates continuously. No such continuous operation is necessary in accordance with the teachings of the present application.

A practical example is perhaps the most straightforward way in which to highlight the clear distinctions between *de la Salle* and the present invention. As is known, a network interface card ("NIC," to use the language of the present application, "network board" to use the language of *de la Salle*) can be readily installed in many different computers. The system of the present invention is specifically adapted to detect situations in which a NIC is removed from one computer and installed in a second, even if the second computer is reattached to the network at the same location as the first. The *de la Salle* system, on the other hand would be incapable of detecting such a hardware swap. That is, the particular hardware associated with any given node of a network is of no concern to the *de la Salle* system, only the existence of the node and the presence of some hardware -- any hardware -- at that node. In stark contrast, the identity of particular hardware is precisely the information the present invention seeks to track.

Considering the specific claim language, the deficiencies of de la Salle are undeniably apparent. As a starting point, it is to be noted that independent claims 1, 8, 19, 23, and 24 each explicitly recite "asset management information." *de la Salle*, by its own terms, does not disclose an asset management system, but a network management system. Those of ordinary skill in the art will readily appreciate that this is far from a semantic distinction, given that the objectives of one are distinct and unrelated from those of the other. A network management system is concerned such issues as with "determining the configuration of an expansive network" (*de la Salle*, col. 3, lines 11-12), "ascertaining a network configuration and functionality" (*id.*, lines 14-15), "determining the functional and performance characteristics of a computer network" (*id*, lines 19-20), and "provid[ing] a monitoring and management system which compiles network parameter information" (*id.*, lines 21-23). A network management system is relatively unconcerned with the particulars of the hardware present at each node, but rather with optimizing the operation of whatever hardware is present. An asset management system, on the other hand, is concerned with "what equipment is connected to a network," since such information "is necessary for user support, network planning, corporate financial statements, software purchasing" and the like. *Balloux*, col. 1, lines 21-24.

Each of the independent claims 1, 8, 13, 16, 19, 21, 23, and 24 calls for node identification or asset-management information comprising a "current NIC address value" and a "former NIC address value." Simply stated, nowhere does *de la Salle* teach or suggest retrieving a former value from a network node. Hence, *de la Salle* cannot be characterized as anticipating the independent claims. That is, even if the critical distinction between "asset management" and "network management" is (improperly) ignored, each of the claims recites elements that are neither taught nor suggested by *de la Salle*.

In summary, whereas *de la Salle* is concerned with the question "How is the network configured, and which component of a general class of functionality is connected and communicating with which," the system in accordance with the claimed invention asks the question: "Which particular components at a given location are present, and how might their physical configuration have changed since the last time their status was established?" The answer to the former question would be invisible to systems in accordance with the *de la Salle*, whereas the answer to the latter question is the fundamental objective of the subject invention. In view of these critical distinctions, the claim rejections based upon *de la Salle* cannot stand.

(b) U.S. Patent No. 5,923,850 to Barroux

Unlike *de la Salle*, *Barroux* does purport to be an asset management system rather than a network management system. And unlike *de la Salle*, *Barroux* does appear to associate some type of time or date stamp information with the network node information collected. It might therefore be tempting upon casual consideration to regard *Barroux* as anticipating or rendering obvious the invention disclosed and claimed in the present application, as did the Office Action. However, as shall be discussed below, *Barroux* suffers from deficiencies no less critical -- and perhaps more so -- than *de la Salle*, and provides no support for rejection of the claims at issue.

Barroux appears to disclose a system adapted to monitor both hardware and software components of a network. The *Barroux* system is based upon an "integrated resource 200 for collecting and managing survey information about a network 202...." *Barroux*, col. 3, lines 24-25.

The integrated resource "takes advantage of various TCP/IP services and remote execution of commonly installed procedures to automatically learn about nodes of network 202 [and] collects and analyzes information about [network nodes] and returns that information to [an] asset database 232." *Barroux*, col. 3, lines 43-46, and col. 4, lines 10-12.

As can be observed from Figures 7A, 7B, 7C, and 7D, the asset database contemplated by *Barroux* includes information about the "systems" (Figure 7A), "processors" (Figure 7B), "software packages" (Figure 7C), and "patches" (Figure 7D) present on the network under analysis. *Barroux* further suggests that information is similarly gathered for memory, buses, peripherals, and interfaces in the system. *See Barroux*, col. 10, lines 9-10. As can further be observed from the referenced Figures, each table includes multiple fields of information. Careful consideration of the information maintained in the various *Barroux* information tables exposes a fundamental deficiency of *Barroux*, namely that, like *de la Salle*, *Barroux* assumes away the very problem sought to be solved by the present invention.

With reference to Figure 7A, *Barroux* describes beginning at col. 8, line 65 through col. 9, line 32, the various fields in the "systems table" storing information about "host systems" (computers) on the network. A first field, designated AALID, identifies an IP address of a node on the network. (As an aside, it is well-known to those of ordinary skill in the art that IP addresses may be assigned to networked computers on a highly dynamic basis, making an IP address wholly unsuited to serve as a "unique identifier" of a piece of computer hardware.) Of particular significance, however, is *Barroux's* reference to "a CID number which ***uniquely identifies*** the system operating at the referenced node" *Barroux*, col. 9, lines 7-8 (emphasis added). With this modest statement, *Barroux* utterly assumes away the entire issue about which the present application is concerned. A substantial portion of the Specification of the present application, spanning from page 5, line 27 through page 13, line 9, is devoted to a discussion of the practical unavailability in present systems of the unique node identifier that *Barroux* quite casually and without explanation, assumes to exist!

Similarly, with regard to the "processors table" described with reference to Figure 7B, *Barroux* states, also without explanation, that "each record includes CID field 704" and "a PathTo field 722 that holds a ***unique identifier of the processor on the system*** in standard UNIX device path name format." *Barroux*, col. 9, lines 35-39.

Likewise, with respect to the other tables of information, *Barroux* states as follows:

> "For the memory table, PathTo field 722 holds a ***unique identifier*** of the memory units on the host system in path name format." *Barroux*, col. 10, lines 12-14 (emphasis added).
>
> "The peripherals table includes information about individual peripherals on host systems of network 202. PathTo field 722 includes a ***unique identifier*** of the peripheral on the system in device name path format." *Barroux*, col. 10, lines 24-27 (emphasis added).
>
> "The interfaces table includes information about the interface devices on host systems of network 202. PathTo filed 722 holds the ***unique identifier*** of the interface device of the host system in device path name format." *Barroux*, col. 10, lines 32-35 (emphasis added).

A careful study of *Barroux* has not revealed to the undersigned any further description or explanation of the nature of the purported "unique identifiers" seeming to abound in the *Barroux* system.

Of equal significance is *Barroux*'s failure to teach or suggest the introduction of a temporal dimension to the data for the purposes of establishing a unique identifier for nodes connected to a network in the manner taught by the present application. Although *Barroux* does appear to suggest the maintenance of various time and/or date fields among the information collected, this date data is not used as "identifying information" as disclosed and claimed in the present application.

According to *Barroux*, several pieces of date data are maintained in the "information tables," including, with reference to the "system table" of Figure 7A, an "FUD field 710 [for holding] a time when the configuration information in configuration field 708 was first observed

for the system[, and an] LUD field 712 [for holding] the last time the configuration information in configuration field 708 was observed to be valid." *Barroux*, col. 9, lines 21-25. This date information, however, is used by *Barroux* in order to maintain a configuration "history" for network nodes. *Barroux* states that "[a] change in the contents of configuration field 708 for a given node triggers creation of a new record with a new version number" and that "by examining a series of records for a particular node within system table 700, one can track the system configuration history for each node." *Barroux*, col. 9, lines 29-31 and col. 11, lines 10-12. Nothing in *Barroux* suggests that the date data is used to augment another node-identifier value in order to achieve "unique identification" of a network node. To the contrary, as discussed at length above, *Barroux* simply assumes without discussion that a unique identifier is available for each node.

Thus, while it could be tempting to draw a comparison between the time/date stamping proposed by *Barroux* and the temporal dimension essential to the practice of the present invention, the context in which the *Barroux* time stamping is performed must be carefully considered. Because *Barroux* uses date data merely to provide a configuration history, *Barroux* cannot be said to anticipate the claims of the present application, which call for the transmission (claims 1, 21 and 23), receiving (claim 8) or storage (claims 13, 16, 19 and 24) of "asset management information" comprising a current and former NIC address or node-identifier value. Hence the rejection of the claims based on *Barroux*, like the rejection based on *de la Salle*, cannot stand.

4. Internet Engineering Task Force Requests for Comments

The Office Action's citation to various Requests for Comment ("RFCs") published by the Internet Engineeering Task Force ("IETF") is acknowledged. It is respectfully submitted, however, that any inference that the cited RFCs anticipate or render obvious the claims at issue is misplaced.[4]

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[4] The RFCs are cited in the Office Action under the caption "Specific Response to Interpretation of Applicant's invention. The Office Action does not rely on the cited RFCs in support of any claim rejection.

The cited RFCs appear to relate to the Internet standard "Simple Network Management Protocol," or "SNMP" and related Internet constructs, including CMIP and CMOP. (*See* Office Action, p. 7). As such, the cited RFCs provide no additional basis for the assertions of the Office Action that the subject invention has been anticipated in the prior art. Indeed, the very prior art relied upon by the Office Action (namely, *Barroux*,) states as a premise that SNMP's "primary application has been monitoring network performance rather than asset surveying." *Barrroux*, col. 1, lines 44-47. Asset surveying, on the other hand, is precisely what is disclosed and claimed in the '860 application.

II. CONCLUSION

In view of the foregoing, it is submitted that the claims in the present application recite combinations of elements neither taught nor suggested by the prior art, including the art relied upon for the purposes of rejection in the Office Action. The present invention is directed to solving a problem that is not even recognized by the cited references, and hence involves structures or method steps not present in the prior art.

de la Salle is directed to a network management system, as opposed to an asset management system. *de la Salle* wholly fails to "identify" network nodes as disclosed and claimed in the present application. Further, *de la Salle* fails to associate any date information with the node information it does collect, such that *de la Salle* does not -- and cannot -- utilize "current" and "former" node-identifying values as required by each independent claim in the present application.

Barroux explicitly assumes away the very problem sought to be solved by the present application, namely the lack of reliable "unique indicators" of network hardware. Although Barroux appears to record date data relating to node information it collects, this is done for reasons wholly unrelated to the problem of node identification. Barroux therefore does not transmit (or store) "current" and "former" node-identifier values as required by each independent claim in the present application.

Thus neither *de la Salle* nor *Barroux*, even if considered in a hypothetical combination,[5] teaches or suggests a method or apparatus as disclosed and claimed in the present application.

* * * * *

Reconsideration and withdrawal of the rejections of the claims is therefore requested, such that the application may advance to issue.

Respectfully submitted,

Date: 3-OCT-2000

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[5] The Office Action does not propose a hypothetical combination of the cited references, and no § 103 rejection is advanced.

APPENDIX A

1. A method, executed by a node on a network, said node comprising at least one asset, of transmitting asset-management information about the node, the method comprising:

(a) determining a current address value of a network interface card of the node, referred to as a NIC address value;

(b) retrieving, from a data storage at the node, a former NIC address value for the node; and

(c) transmitting asset-management information concerning the node together with the current NIC address value and the former NIC address value.

2. The method of claim 2, wherein determining the current NIC address value includes an attempt to detect the then-current NIC address value.

3. The method of claim 2, wherein the attempt to detect the then-current NIC address value is unsuccessful, and further comprising (i) retrieving, from a data storage at the node, a stored value containing the result of the past live detection of the then-current NIC address value, referred to as a previously-detected NIC address value; and (ii) transmitting the previously-detected NIC address value.

4. (previously canceled)

5. The method of claim 1, wherein the NIC address value comprises a signature portion and a pseudorandomly generated portion.

6. The method of claim 1, wherein the former NIC address value is redundantly stored in multiple partitions within the data storage at the node.

7. The method of claim 6, wherein (x) each copy of the former NIC address value is associated with a timestamp, and (y) retrieving the former NIC address value comprises retrieving the respective copy associated with the most recent timestamp.

8. A method, executed by a server node on a network, for recording, in a database, asset-management information about a client node, comprising:

(a) retrieving, from the client node, (1) asset-management information about the client node, (2) a current address value of a network interface card of the client node, referred to as a current NIC address value and (3) a former NIC address value for the client node that is equal to the current NIC address value;

(b) unsuccessfully attempting to locate, in the database, a record corresponding to the current NIC address value;

(c) unsuccessfully attempting to locate, in the database, a record corresponding to the former NIC address value; and

(d) storing the asset-management information, the current NIC address value, and the former NIC address value in a record in the database associated with the current NIC address value.

9. (previously canceled)

10. The method of claim 8, wherein the NIC address value comprises a signature portion and a pseudorandomly generated portion.

11. A program storage device readable by a processor in the client node of a specified one of claims 1 through 3, 5 through 7, and 21 through 24, and encoding a program of instructions including instructions for performing the operations recited in the specified claim as being performed by the client node.

12. A program storage device readable by a processor in the server node of a specified one of claims 8, 10, and 24 and encoding a program of instructions including instructions for performing the operations recited in said specified claim as being performed by the client node.

13. In a node on a network, a data store comprising a machine-readable data structure accessible to a processor in the node and containing node-identification information for the client node that includes (i) a current network interface card value for the node, referred to as a NIC address value, and (ii) a former NIC address value.

14. (previously canceled)

15. The data store of claim 13, wherein the NIC address value that constitutes the current node-identifier value includes a signature portion and a pseudorandomly generated portion.

16. In a node on a network, a data store comprising:

(a) a plurality of machine-readable data structures accessible to a processor in the node;

(b) each said data structure containing node-identification information for the client node that includes (i) a current node-identifier value, and (ii) a former node-identifier value, each said value comprising a network interface card address value, referred to as a NIC address value;

(c) each said data structure being associated with a timestamp.

17. (previously canceled)

18. The data store of claim 16, wherein the NIC address value comprises a signature portion and a pseudorandomly generated portion.

19. In a server node on a network, that includes a client node, a machine-readable data structure accessible to a processor in the server node, comprising (i) a current value of a network interface card address for the client node, referred to as a current NIC address value for the client node, (ii) a former NIC address value for the client node, and (iii) asset-management information about the client node.

20. The machine-readable data structure of claim 19, wherein the current NIC address value comprises a signature portion and a pseudorandomly generated portion.

21. A method, executed by a node on a network, of transmitting asset-management information about the node, the method comprising:

(a) determining a current node identifier value, where (1) the node identifier value for any particular node in the network is dependent upon one or more node-identification attributes of that node including an address value of a network interface card in the node, referred to as a NIC address value, and (2) determining the current node identifier value includes an attempt to detect the then-current values of said one or more node-identification attributes;

(b) retrieving, from a data storage at the node, a former node identifier value for the node; and

(c) transmitting asset-management information about the node together with the current node-identifier value and the former node identifier value.

22. The method of claim 21, wherein the attempt to detect said one or more node-identification attributes fails to detect at least one of said node-identification attributes, and further comprising (i) retrieving, from a data storage at the node, a stored value containing the result of a past live detection of the said one or more node-identification attributes, referred to as a previously-detected node identifier value; and (ii) transmitting the previously-detected node identifier value.

23. A method, executed by a node on a network, of transmitting asset-management information about the node, the method comprising:

(a) attempting but failing to detect a current network interface card address value for the node, referred to as a current NIC address value;

(b) retrieving, from a data storage at the node, a previously-detected NIC address value;

(c) retrieving, from a data storage at the node, a stored value of a former NIC address value for that node; and

(d) transmitting the asset-management information together with the previously-detected NIC address value and the former NIC address value.

24. A method, executed by a client node and a server node on a network, for recording, in a database, asset-management information about the client node, comprising:

(a) the client node (1) determining a current address value of a network interface card in the node, referred to as a NIC address value, (2) retrieving, from a data storage at the node, a former NIC address value for the node, and (3) transmitting to the server node asset-management information, the current NIC address value, and the former NIC address value;

(b) the server node (1) unsuccessfully attempting to locate, in the database, a record corresponding to the current NIC address value, (2) locating, in the database, a record corresponding to the former NIC address value, (3) recording the asset-management information in said record, and (4) updating the record to correspond to the current NIC address value instead of the former NIC address value.

B

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Refine Search ACLM/"program storage device" AND ACLM/"tangibly em

	PAT. NO.	Title
1	6,125,208	Writing recognition unit
2	6,122,674	Bi-directional network adapter for interfacing local node of shared memory parallel processing system to multi-stage switching network for communications with remote node
3	6,122,659	Memory controller for controlling memory accesses across networks in distributed shared memory processing systems
4	6,122,631	Dynamic server-managed access control for a distributed file system
5	6,122,628	Multidimensional data clustering and dimension reduction for indexing and searching
6	6,119,247	Remote debugging of internet applications
7	6,119,095	System for planning and revising an itinerary based on intended travel time and expected consumption time
8	6,119,086	Speech coding via speech recognition and synthesis based on pre-enrolled phonetic tokens
9	6,118,897	Interactive drawing recognition processing method and apparatus thereof
10	6,118,892	Method for automatic detection of region of interest for digital x-ray detectors using a filtered histogram
11	6,118,846	Bad pixel column processing in a radiation detection panel
12	6,117,183	Interactive CAD apparatus for designing packaging of logic circuit design
13	6,115,736	System and method for automatically localizing access to remote network components using implicit agent relocation
14	6,115,721	System and method for database save and restore using self-pointers

15 6,113,394 Reading aid

16 6,112,987 Method of executing a transaction on a smartcard, a smartcard and a transaction processing system including a smartcard

17 6,111,984 Method for matching input image with reference image, apparatus for the same, and storage medium storing program for implementing the method

18 6,110,228 Method and apparatus for software maintenance at remote nodes

19 6,108,700 Application end-to-end response time measurement and decomposition

20 6,108,684 Methods and apparatus for balancing loads on a storage subsystem among a plurality of controllers

21 6,108,666 Method and apparatus for pattern discovery in 1-dimensional event streams

22 6,108,425 Method and apparatus for controlling the configuration of a cryptographic processor

23 6,106,561 Simulation gridding method and apparatus including a structured areal gridder adapted for use by a reservoir simulator

24 6,105,122 I/O protocol for highly configurable multi-node processing system

25 6,104,840 Method and system for generating a composite image from partially overlapping adjacent images taken along a plurality of axes

26 6,104,835 Automatic knowledge database generation for classifying objects and systems therefor

27 6,104,810 Pseudorandom number generator with backup and restoration capability

28 6,104,394 Data processing system for automatic storage of objects of an object type within a logical containment system and method therefor

29 6,102,287 Method and apparatus for providing product survey information in an electronic payment system

30 6,101,524 Deterministic replay of multithreaded applications

31 6,101,472 Data processing system and method for navigating a network using a voice command

32 6,101,275 Method for finding a best test for a nominal attribute for generating a binary decision tree

33 6,100,902 Image data approximation considering normal vectors

34 6,100,901 Method and apparatus for cluster exploration and visualization

35 6,098,184 Method for improving mouse performance and virtual device driver therefor

36 6,098,122 Method and apparatus for adaptively blocking outgoing communication requests and adjusting the blocking factor according to the volume of requests being received in an information handling system

37 6,098,115 System for reducing storage access latency with accessing main storage and data bus simultaneously

38 6,097,386 Data processing system having context sensitive visual feedback for user interface controls and method therefor

39 6,097,320 Encoder/decoder system with suppressed error propagation

40 6,094,651 Discovery-driven exploration of OLAP data cubes

41 6,092,083 Database management system which synchronizes an enterprise server and a workgroup user client using a docking agent

42 6,092,065 Method and apparatus for discovery, clustering and classification of patterns in 1-dimensional event streams

43 6,092,038 System and method for providing lossless compression of n-gram language models in

a real-time decoder

44 6,092,025 Hydrocarbon edge detection using seismic amplitude

45 6,088,798 Digital signature method using an elliptic curve, a digital signature system, and a program storage medium having the digital signature method stored therein

46 6,088,705 Method and apparatus for loading data into a database in a multiprocessor environment

47 6,088,032 Computer controlled display system for displaying a three-dimensional document workspace having a means for prefetching linked documents

48 6,088,027 Method and apparatus for screen object manipulation

49 6,088,005 Design and method for a large, virtual workspace

50 6,085,295 Method of maintaining data coherency in a computer system having a plurality of interconnected nodes

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	PAT. NO.	Title
51	6,085,258	State machine for selectively performing an operation on a single or a plurality of registers depending upon the register address specified in a packet
52	6,085,223	Method and apparatus for providing database information to non-requesting clients
53	6,085,217	Method and apparatus for controlling the assignment of units of work to a workload enclave in a client/server system
54	6,085,197	Object graph editing context and methods of use
55	6,084,582	Method and apparatus for recording a voice narration to accompany a slide show
56	6,084,553	Design and method for a large, virtual workspace
57	6,083,271	Method and apparatus for specifying multiple power domains in electronic circuit designs
58	6,081,812	Identifying at-risk components in systems with redundant components
59	6,081,624	Spatial index compression through spatial subdivision encoding
60	6,081,397	Method and apparatus for SID-to-SID period estimation
61	6,081,262	Method and apparatus for generating multi-media presentations
62	6,080,201	Integrated placement and synthesis for timing closure of microprocessors
63	6,078,990	Volume set configuration using a single operational view
64	6,078,925	Computer program product for database relational extenders
65	6,078,400	Printing system having function of displaying error information and method of displaying error information

66 6,076,110 System and method for server virtual device name negotiation
67 6,076,106 User interface for displaying information about a computer network
68 6,076,043 Utilization effectiveness of nutrients in a population
69 6,073,218 Methods and apparatus for coordinating shared multiple raid controller access to common storage devices
70 6,073,157 Program execution in a software run-time environment
71 6,073,146 System and method for processing chinese language text
72 6,073,096 Speaker adaptation system and method based on class-specific pre-clustering training speakers
73 6,073,095 Fast vocabulary independent method and apparatus for spotting words in speech
74 6,073,091 Apparatus and method for forming a filtered inflected language model for automatic speech recognition
75 6,070,245 Application interface method and system for encryption control
76 6,070,235 Data processing system and method for capturing history buffer data
77 6,070,190 Client-based application availability and response monitoring and reporting for distributed computing environments
78 6,070,073 Communication system and method for notification and call routing in a mobile satellite network
79 6,069,630 Data processing system and method for creating a link map
80 6,067,513 Speech recognition method and speech recognition apparatus
81 6,065,088 System and method for interrupt command queuing and ordering
82 6,065,058 Dynamic push filtering based on information exchanged among nodes in a proxy hierarchy
83 6,065,019 Method and apparatus for allocating and freeing storage utilizing multiple tiers of storage organization
84 6,064,799 Method and apparatus for controlling the radial temperature gradient of a wafer while ramping the wafer temperature
85 6,064,762 System and method for separating foreground information from background information on a document
86 6,063,133 No preprocessor for embedded SQL in a 3GL
87 6,061,741 Method and apparatus for synchronization of connectionless applications across a network by using simple encryption tokens
88 6,061,703 Pseudorandom number generator with normal and test modes of operation
89 6,061,669 Notification system for access to and printing of proprietary network services
90 6,061,606 Geometric phase analysis for mask alignment
91 6,059,842 System and method for optimizing computer software and hardware
92 6,058,416 Flexible state sharing and consistency mechanism for interactive applications
93 6,058,301 Cellular fraud prevention using selective roaming
94 6,058,188 Method and apparatus for interoperable validation of key recovery information in a cryptographic system
95 RE36,683 Apparatus and method for audio data compression and expansion with reduced block floating overhead
96 6,055,562 Dynamic mobile agents

97 6,055,558 Pacing of multiple producers when information is required in natural order

98 6,055,539 Method to reduce I/O for hierarchical data partitioning methods

99 6,055,433 Data processing system and method for balancing a load in a communications network

100 6,055,418 Computer program product configured to control modular transmission system components

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	PAT. NO.	Title
101	6,054,985	Data processing system and method for simulating compound objects
102	6,052,680	Method and apparatus for determining whether to route an input to a process based on a relevance between the input and the process
103	6,052,476	Method and apparatus for controlling x-ray angiographic image acquistion
104	6,052,469	Interoperable cryptographic key recovery system with verification by comparison
105	6,049,767	Method for estimation of feature gain and training starting point for maximum entropy/minimum divergence probability models
106	6,047,130	Apparatus and method for portrait photography
107	RE36,647	System for transmitting and receiving digital information through parallel printer port of computer by using embedding strobe bit in eight bit data of printer port
108	6,044,388	Pseudorandom number generator
109	6,041,419	Programmable delay timing calibrator for high speed data interface
110	6,041,133	Method and apparatus for fingerprint matching using transformation parameter clustering based on local feature correspondences
111	6,040,586	Method and system for velocity-normalized position-based scanning
112	6,038,574	Method and apparatus for clustering a collection of linked documents using co-citation analysis
113	6,038,526	Method for detecting weak signals in a non-gaussian and non-stationary background
114	6,038,517	Computer system and method for dynamically assessing the market readiness of a

product under development

115 6,038,225 Communication system capable of switching between frames of differing configuration during communication, and a control method for the same

116 6,035,271 Statistical methods and apparatus for pitch extraction in speech recognition, synthesis and regeneration

117 6,035,110 Identifying candidate nodes for phase assignment in a logic network

118 6,035,072 Mapping defects or dirt dynamically affecting an image acquisition device

119 6,034,689 Web browser allowing navigation between hypertext objects using remote control

120 6,032,198 Application design supporting method and apparatus for client/server system

121 6,031,541 Method and apparatus for viewing panoramic three dimensional scenes

122 6,026,413 Determining how changes to underlying data affect cached objects

123 6,026,340 Automotive occupant sensor system and method of operation by sensor fusion

124 6,026,224 Redundant vias

125 6,025,842 System and method for window queues and white space activation for toggling windows

126 6,025,839 Method for displaying information in a virtual reality environment

127 6,024,572 Means for adding educational enhancements to computer games

128 6,023,712 Method and apparatus for brokering memory resources

129 6,023,698 System and method for transparently registering and updating information over the internet

130 6,023,567 Method and apparatus for verifying timing rules for an integrated circuit design

131 6,021,442 Method and apparatus for partitioning an interconnection medium in a partitioned multiprocessor computer system

132 6,018,621 Identifying an optimizable logic region in a logic network

133 6,018,498 Automated seismic fault detection and picking

134 6,018,346 Freeform graphics system having meeting objects for supporting meeting objectives

135 6,016,491 Generic file format for multiple security requirements

136 6,016,287 Apparatus and method for accurately determining the location of events such as peaks in seismic data

137 6,016,143 Multi-device direct I/O object that generates transactions capable of controlling multiple instruments and transaction dialog boxes having device and address fields

138 6,015,949 System and method for applying a harmonic change to a representation of musical pitches while maintaining conformity to a harmonic rule-base

139 6,015,667 Multicomponent analysis method including the determination of a statistical confidence interval

140 6,014,692 Web browser file system attachment

141 6,014,510 Method for performing timing analysis of a clock circuit

142 6,014,508 Method of adding constrained cluster points to interconnection nets in integrated circuit chips and packages

143 6,014,117 Ambient vision display apparatus and method

144 6,012,126 System and method for caching objects of non-uniform size using multiple LRU stacks partitions into a range of sizes

145 6,012,084 Virtual network communication services utilizing internode message delivery task

mechanisms

146 6,011,559 Layout method for arc-dominated labelled graphs

147 6,011,211 System and method for approximate shifting of musical pitches while maintaining harmonic function in a given context

148 6,006,196 Method of estimating future replenishment requirements and inventory levels in physical distribution networks

149 6,005,597 Method and apparatus for program selection

150 6,003,620 Downhole in-situ measurement of physical and or chemical properties including fluid saturations of cores while coring

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	PAT. NO.	Title
151	6,003,095	Apparatus and method for demand loading a dynamic link library
152	6,003,048	System and method for converting a coordinate based document to a markup language (ML) based document
153	6,003,029	Automatic subspace clustering of high dimensional data for data mining applications
154	6,001,013	Video dance game apparatus and program storage device readable by the apparatus
155	6,000,033	Password control via the web
156	5,999,488	Method and apparatus for migration by finite differences
157	5,999,255	Method and apparatus for measuring Raman spectra and physical properties in-situ
158	5,996,090	Method and apparatus for quantitative diagnosis of performance problems using external representations
159	5,996,056	Apparatus for reducing a computational result to the range boundaries of a signed 8-bit integer in case of overflow
160	5,995,938	Medication compliance system
161	5,995,931	Method for modeling and recognizing speech including word liaisons
162	RE36,422	Debugging system wherein multiple code views are simultaneously managed
163	5,991,787	Reducing peak spectral error in inverse Fast Fourier Transform using MMX.TM. technology
164	5,991,688	Route setting method and apparatus in navigation system, and program storage device readable by the apparatus

165 5,987,240 Design rules checker for an integrated circuit design

166 5,987,124 Method and apparatus for encrypting long blocks using a short-block encryption procedure

167 5,984,023 Downhole in-situ measurement of physical and or chemical properties including fluid saturations of cores while coring

168 5,983,341 Data processing system and method for extending the time for execution of an instruction

169 5,983,020 Rule-based engine for transformation of class hierarchy of an object-oriented program

170 5,981,957 Signal generation and mixing electronics for frequency-domain lifetime and spectral fluorometry

171 5,978,936 Run time error probe in a network computing environment

172 5,978,792 Method and apparatus for generating dynamic and hybrid sparse indices for workfiles used in SQL queries

173 5,978,580 Passing arrays to stored procedures

174 5,978,576 Computer performance modeling system and method

175 5,978,425 Hybrid phase-locked loop employing analog and digital loop filters

176 5,978,384 Introducing inter-packet gaps in network transmissions

177 5,977,890 Method and apparatus for data compression utilizing efficient pattern discovery

178 5,974,462 Method and apparatus for controlling the number of servers in a client/server system

179 5,974,194 Projection based method for scratch and wire removal from digital images

180 5,970,494 Computer program product and program storage device for a data transmission dictionary for encoding, storing, and retrieving hierarchical data processing information for a computer system

181 5,970,250 System, method, and computer program product for scoping operating system semanticis in a computing environment supporting multi-enclave processes

182 5,970,245 Method for debugging shared procedures contained in dynamic link library files

183 5,970,239 Apparatus and method for performing model estimation utilizing a discriminant measure

184 5,969,720 Data processing system and method for implementing an informative container for a file system

185 5,966,135 Vector-based geographic data

186 5,963,953 Method, and system for product configuration

187 5,963,950 Method and system for facilitating access to selectable elements on a graphical user interface

188 5,961,601 Preserving state information in a continuing conversation between a client and server networked via a stateless protocol

189 5,960,421 Service interface repository internationalization

190 5,960,181 Computer performance modeling system and method

191 5,960,169 Transformational raid for hierarchical storage management system

192 5,959,300 Attenuation correction in a medical imaging system using computed path lengths and attenuation values of a model attenuation medium

193 5,956,728 Object graph editing context and methods of use

194 5,956,712 Byte range locking in a distributed environment

195 5,956,708 Integration of link generation, cross-author user navigation, and reuse identification in authoring process

196 5,955,737 Chemometric analysis for extraction of individual fluorescence spectrum and lifetimes from a target mixture

197 5,953,532 Installation and deinstallation of application programs

198 5,953,420 Method and apparatus for establishing an authenticated shared secret value between a pair of users

199 5,953,051 Method and apparatus for controlling access in a video distribution network

200 5,951,394 Controller to maintain a certain set of environmental parameters in an environment

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	PAT. NO.	Title
201	5,950,211	Discarded history method for solving streams message block leakages
202	5,950,184	Indexing a database by finite-state transducer
203	5,949,375	Method of and apparatus for calculating position of movable body in navigation system, method of and apparatus for correcting the position, and program storage device readable by the apparatus
204	5,946,486	Apparatus and method for tracing entries to or exits from a dynamic link library
205	5,946,475	Method for performing transistor-level static timing analysis of a logic circuit
206	5,946,465	Method and system for recovering system resources used by an inactive Telnet client
207	5,944,839	System and method for automatically maintaining a computer system
208	RE36,286	Preemptive demount in an automated storage library
209	5,940,877	Cache address generation with and without carry-in
210	5,940,840	Phantom files for dynamic read bandwidth measurements of computer disks
211	5,940,825	Adaptive similarity searching in sequence databases
212	5,940,616	Tracker class for object-oriented programming environments
213	5,940,593	Simulating a multi-tiered computer environment on a single development system for debugging
214	5,937,066	Two-phase cryptographic key recovery system
215	5,936,624	Data processing system having a logical containment system and method therefor
216	5,936,181	System and method for applying a role-and register-preserving harmonic

transformation to musical pitches

217 5,933,824 Methods and apparatus for locking files within a clustered storage environment

218 5,933,601 Method for systems management of object-based computer networks

219 5,931,912 Traversal path-based approach to understanding user-oriented hypertext object usage

220 5,930,811 Document processing apparatus

221 5,930,793 Performance optimization in a heterogeneous, distributed database environment

222 5,930,786 Method and apparatus for providing shared data to a requesting client

223 5,930,512 Method and apparatus for building and running workflow process models using a hypertext markup language

224 5,926,637 Service interface repository code generation data

225 5,926,089 Electric power system protection and control system and distributed control system

226 5,924,092 Computer system and method which sort array elements to optimize array modifications

227 5,923,890 Method and apparatus for optimizing the handling of synchronous requests to a coupling facility in a sysplex configuration

228 5,923,334 Polyhedral environment map utilizing a triangular data structure

229 5,923,018 Medical care schedule and record aiding system, medical care schedule and record aiding method, and program storage device readable by the system

230 5,920,717 Method and apparatus for automated program-generation

231 5,918,006 Communication device provided with a storage medium for storing a control program

232 5,917,998 Method and apparatus for establishing and maintaining the status of membership sets used in mirrored read and write input/output without logging

233 5,917,723 Method and apparatus for transferring data between two devices with reduced microprocessor overhead

234 5,917,499 Interactive graph display system

235 5,917,478 Memory allocation method and apparatus for compression and decoding picture data

236 5,916,307 Method and structure for balanced queue communication between nodes in a distributed computing application

237 5,913,197 Medical care schedule and record aiding system and method

238 5,912,831 Process and system for adding or substracting symbols in any base without converting to a common base

239 5,912,670 Method and apparatus for overlaying a bit map image on an environment map

240 5,912,669 Screen navigation method

241 5,910,796 Monitor gamma determination and correction

242 5,909,593 System for assigning snoop levels to snooper modules and selectively invoking snooper modules having specified relation to a selected snoop level for hardware detection

243 5,908,470 Method for contention-free access and management of timers in multiprocessing environments

244 5,907,618 Method and apparatus for verifiably providing key recovery information in a cryptographic system

245 5,905,982 Handling null values in SQL queries over object-oriented data

246 5,905,889 Resource management system using next available integer from an integer pool and

returning the integer thereto as the next available integer upon completion of use

247 5,903,467 Selecting phase assignments for candidate nodes in a logic network

248 5,901,288 Network operating information system having design device and automatic setting device

249 5,899,992 Scalable set oriented classifier

250 5,899,855 Modular microprocessor-based health monitoring system

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	PAT. NO.	Title
251	5,897,618	Data processing system and method for switching between programs having a same title using a voice command
252	5,895,491	Apparatus and method for writing an item to a line in a memory table shared by multiple processors
253	5,894,516	Broadcast software distribution
254	5,893,916	Method of converting man pages to help topic files
255	5,893,911	Method for defining and applying rules for message distribution for transaction processing in a distributed application
256	5,893,905	Automated SLA performance analysis monitor with impact alerts on downstream jobs
257	5,893,108	System, method, and computer program product for efficiently translating relational tuples to object-oriented objects
258	5,893,063	Data processing system and method for dynamically accessing an application using a voice command
259	5,892,853	Methods, apparatus and program storage device for removing scratch or wire noise, and recording media therefor
260	5,892,506	Multitrack architecture for computer-based editing of multimedia sequences
261	5,890,158	Method, apparatus, and program storage device for sharing objects with a network server and a database server using a common object model
262	5,890,148	System and method for generating uniqueness information for optimizing an SQL

query

263 5,889,764 Low-latency multi-party audio chat

264 5,887,184 Method and apparatus for partitioning an interconnection medium in a partitioned multiprocessor computer system

265 5,886,694 Method for automatically laying out controls in a dialog window

266 5,884,685 Quality prediction and quality control of continuous-cast steel

267 5,884,324 Agent for replicating data based on a client defined replication period

268 5,884,318 Method and system for facilitating access to selectable elements on a graphical user interface

269 5,884,284 Telecommunication user account management system and method

270 5,883,818 Method for generating an improved model for evaluating the operation of an integrated circuit design

271 5,881,268 Comparative performance modeling for distributed object oriented applications

272 5,881,238 System for assignment of work requests by identifying servers in a multisystem complex having a minimum predefined capacity utilization at lowest importance level

273 5,881,232 Generic SQL query agent

274 5,881,219 Random reliability engine for testing distributed environments

275 5,878,424 Method and apparatus for indexing patterned sparse arrays for microprocessor data cache

276 5,875,431 Legal strategic analysis planning and evaluation control system and method

277 5,875,337 Modifier for a program executing parallel processes that reduces wait time for access to a shared resource

278 5,873,052 Alignment-based similarity scoring methods for quantifying the differences between related biopolymer sequences

279 5,873,051 Method and apparatus for processing at least two seismic data sets during a step to derive a third data set

280 5,872,848 Method and apparatus for witnessed authentication of electronic documents

281 5,872,672 System and method for monitoring and analyzing tape servo performance

282 5,870,470 Method and apparatus for encrypting long blocks using a short-block encryption procedure

283 5,867,736 Methods for simplified integration of host based storage array control functions using read and write operations on a storage array control port

284 5,864,843 Method and apparatus for extending a database management system to operate with diverse object servers

285 5,864,842 Optimization of SQL queries using hash star join operations

286 5,864,700 Sequencing and error detection of template instantiations during compilation of C++ Programs

287 5,864,655 Managing removable media in raid and rail environments

288 5,862,378 Passing arrays to stored procedures

289 5,860,929 Fractional moving blood volume estimation with power doppler ultrasound

290 5,850,619 Frozen precipitation accumlation alert system

291 5,850,550 No preprocessor and a source level debugger for embedded SQL in a 3GL

292 5,850,549 Global variable coalescing

293 5,850,544 System and method for efficient relational query generation and tuple-to-object translation in an object-relational gateway supporting class inheritance

294 5,847,706 Sizeable window for tabular and graphical representation of data

295 5,847,691 Microkeyer for microcomputer broadcast video overlay of a DC restored external video signal with a computer's DC restored video signal

296 5,845,274 Computer program product for avoiding complete index tree traversals in sequential and almost sequential index probes

297 5,845,121 Expression evaluation in a multi-language debugger

298 5,845,068 Multilevel security port methods, apparatuses, and computer program products

299 5,842,209 User interface for visually depicting inner/outer/left/right joins in a database system

300 5,842,208 High performance recover/build index system by unloading database files in parallel

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	PAT. NO.	Title
301	5,841,678	Modeling and simulation of a reaction for hydrotreating hydrocarbon oil
302	5,838,958	Automatic track following sync timing
303	5,835,883	Method for determining distribution of reservoir permeability, porosity and pseudo relative permeability
304	5,835,882	Method for determining barriers to reservoir flow
305	5,835,770	User inquiry facility for task status in a distributed system
306	5,835,638	Method and apparatus for comparing symbols extracted from binary images of text using topology preserved dilated representations of the symbols
307	5,835,091	Manipulating and displaying a plurality of views in a graphical user interface
308	5,832,477	Method and apparatus for reordering complex SQL queries containing inner and outer join operations
309	5,826,257	Method and structure for maintaining and utilizing a lookup value associated with a stored database value
310	5,826,016	Pass-word managing system and pass-word managing method
311	5,819,276	Method for supporting multiple file-systems in file input/output operations
312	5,819,116	System for transmitting and receiving combination of compressed audio information and embedded strobe bit between computer and external device through parallel printer port of computer
313	5,818,458	Graphic-shaping method and apparatus for producing axissymmetrical graphic with

respect to valid symmetry axes

314 5,815,573 Cryptographic key recovery system

315 5,813,011 Storage of a compressed file containing its own compression management table

316 5,812,430 Componentized digital signal processing

317 5,812,135 Reorganization of nodes in a partial view of hierarchical information

318 5,809,302 System and method for enabling pointers to be passed from computer programs written using computer programming languages that do not support pointers

319 5,809,211 Ramping susceptor-wafer temperature using a single temperature input

320 5,806,060 Interactive data analysis employing a knowledge base

321 5,805,891 System and method for managing maintenance of computer software

322 5,805,863 Memory pattern analysis tool for use in optimizing computer program code

323 5,805,849 Data processing system and method for using an unique identifier to maintain an age relationship between executing instructions

324 5,805,457 System for analyzing sound quality in automobiles using musical intervals

325 5,802,492 Computer aided routing and positioning system

326 5,802,354 Method and apparatus for synchronizing selected logical partitions of a partitioned information handling system to a test datesource

327 5,802,344 Method and apparatus for dynamic segment allocation in log structured arrays

328 5,801,693 "Clear" extension to a paste command for a clipboard function in a computer system

329 5,799,309 Generating an optimized set of relational queries fetching data in an object-relational database

330 5,799,297 Task workflow management system and method including an external program execution feature

331 5,798,950 Method and apparatus for estimating durations of activities in forming a current system, based on past durations of activities in forming past systems

332 5,798,769 Method and apparatus for maintaining links between graphic objects in a free-form graphics display system

333 5,797,012 Connectivity based program partitioning

334 5,797,000 Method of performing a parallel relational database query in a multiprocessor environment

335 5,796,951 System for displaying information relating to a computer network including association devices with tasks performable on those devices

336 5,796,830 Interoperable cryptographic key recovery system

337 5,796,400 Volume-based free form deformation weighting

338 5,794,250 Method and apparatus for extending existing database management system for new data types

339 5,793,885 Computationally efficient low-artifact system for spatially filtering digital color images

340 5,793,495 Method for avoiding creation of duplicate keyword objects representing user entered data on a machine readable form

341 5,793,377 Method and apparatus for polar coordinate snap in a computer implemented drawing tool

342 5,790,867 Compiler with extended redundant copy elimination

343 5,787,418 Find assistant for creating database queries
344 5,787,411 Method and apparatus for database filter generation by display selection
345 5,787,287 Representation of control flow and data dependence for machine
346 5,787,284 Improving memory layout based on connectivity considerations
347 5,787,283 Framework for manufacturing logistics decision support
348 5,787,005 Method and apparatus for signal threshold adjustment that compensates for signal asymmetry
349 5,787,001 Method for using sorting techniques in a type-safe way
350 5,786,907 High speed color compensation system

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	PAT. NO.	Title
351	5,786,826	Method and apparatus for parallel rasterization
352	5,784,612	Configuration and unconfiguration of distributed computing environment components
353	5,784,294	System and method for comparative molecular moment analysis (CoMMA)
354	5,781,906	System and method for construction of a data structure for indexing multidimensional objects
355	5,781,546	Route restrictions for deadlock free routing with increased bandwidth in a multi-stage cross point packet switch
356	5,778,375	Database normalizing system
357	5,778,353	Computer program product for optimizing data retrieval using index scanning
358	5,778,092	Method and apparatus for compressing color or gray scale documents
359	5,775,993	Roulette gaming machine
360	5,774,716	Computer program product to enable multiple computer systems to share single sequential log
361	5,774,552	Method and apparatus for retrieving X.509 certificates from an X.500 directory
362	5,771,129	Method and apparatus for detecting and matching the recorded speed of previously recorded tape
363	5,768,606	Method, system, computer program product and program storage device for declaring column widths of matrices

364 5,768,603 Method and system for natural language translation
365 5,768,577 Performance optimization in a heterogeneous, distributed database environment
366 5,768,390 Cryptographic system with masking
367 5,764,913 Computer network status monitoring system
368 5,764,889 Method and apparatus for creating a security environment for a user task in a client/server system
369 5,761,660 Computer program product and program storage device for database access using a shared electronic store in a multi-system environment having shared disks
370 5,761,657 Global optimization of correlated subqueries and exists predicates
371 5,761,652 Constructing balanced multidimensional range-based bitmap indices
372 5,761,515 Branch on cache hit/miss for compiler-assisted miss delay tolerance
373 5,761,078 Field programmable gate arrays using semi-hard multicell macros
374 5,760,716 Vector data compression
375 5,758,339 Method of identifying shared and unshared information using system chapters, a sysplex chapter, a table of contents, and a header
376 5,758,147 Efficient information collection method for parallel data mining
377 5,758,145 Method and apparatus for generating dynamic and hybrid sparse indices for workfiles used in SQL queries
378 5,754,841 Method and apparatus for parallel execution of user-defined functions in an object-relational database management system
379 5,754,760 Automatic software testing tool
380 5,752,017 Method and apparatus for executing complex SQL queries using projection operations
381 5,751,992 Computer program product for continuous destaging of changed data from a shared cache in a multisystem shared disk environment wherein castout interest is established in a hierarchical fashion
382 5,751,962 Object-based systems management of computer networks
383 5,748,929 Program storage device and computer program product for interactively managing a distributed database system
384 5,748,884 Autonotification system for notifying recipients of detected events in a network environment
385 5,748,809 Active area identification on a machine readable form using form landmarks
386 5,748,491 Deconvolution method for the analysis of data resulting from analytical separation processes
387 5,745,768 Computer program product and program storage device for supporting native and non-native signals transferred between processing entities of a computer program
388 5,745,692 Automated systems administration of remote computer servers
389 5,745,685 Protocol extension in NSPP using an acknowledgment bit
390 5,742,810 System, method and computer program product for passing host variables to a database management system
391 5,742,670 Passive telephone monitor to control collaborative systems
392 5,737,611 Methods for dynamically escalating locks on a shared resource
393 5,737,593 System and method for defining shapes with which to mine time sequences in

computerized databases

394 5,737,591 Database view generation system

395 5,737,580 Wiring design tool improvement for avoiding electromigration by determining optimal wire widths

396 5,737,520 Method and apparatus for correlating logic analyzer state capture data with associated application data structures

397 5,737,424 Method and system for secure distribution of protected data using elliptic curve systems

398 5,734,811 Segment substitution/swap for network restoration pre-plans

399 5,734,582 Method and system for layout and schematic generation for heterogeneous arrays

400 5,731,985 Chip sizing for hierarchical designs

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	PAT. NO.	Title
401	5,729,228	Parallel compression and decompression using a cooperative dictionary
402	5,727,199	Database mining using multi-predicate classifiers
403	5,724,568	Reordering complex SQL queries containing inner and outer join operations using hypergraphs and required sets
404	5,724,564	Computer program product and program storage device for representing and signaling run-time program conditions
405	5,721,915	Interaction between application of a log and maintenance of a table that maps record identifiers during online reorganization of a database
406	5,717,865	Method for assisting individuals in decision making processes
407	5,717,835	Simple approach to case-based reasoning for data navigation tasks
408	5,715,400	System and method for providing merchant information and establishing links to merchants while presenting a movie
409	5,713,015	Reordering of complex SQL queries involving GROUPBYs, joins, outer joins and full outer joins
410	5,712,986	Asynchronous PCI-to-PCI Bridge
411	5,710,578	Computer program product for utilizing fast polygon fill routines in a graphics display system
412	5,708,759	Speech recognition using phoneme waveform parameters
413	5,706,512	Computer program product for queuing and retrieving data objects to and from a

shared storage medium

414 5,706,499 Functional compensation in a heterogeneous, distributed database environment

415 5,706,437 System and method for accessing a service on a services network

416 5,706,349 Authenticating remote users in a distributed environment

417 5,706,194 Non-unique seismic lithologic inversion for subterranean modeling

418 5,701,460 Intelligent joining system for a relational database

419 5,701,456 System and method for interactively formulating database queries using graphical representations

420 5,701,455 Method and apparatus for reordering complex SQL queries using a modified generalized outer join operator

421 5,701,454 Simplification of SQL queries using generalized inference propagation and generalized transitive closure

422 5,696,960 Computer program product for enabling a computer to generate uniqueness information for optimizing an SQL query

423 5,696,713 Method for faster division by known divisor while maintaining desired accuracy

424 5,694,342 Method for detecting signals in non-Gaussian background clutter

425 5,692,182 Bufferpool coherency for identifying and retrieving versions of workfile data using a producing DBMS and a consuming DBMS

426 5,692,174 Query parallelism in a shared data DBMS system

427 5,692,156 Computer program product for overflow queue processing

428 5,692,129 Managing application programs in a computer network by using a database of application objects

429 5,689,698 Method and apparatus for managing shared data using a data surrogate and obtaining cost parameters from a data dictionary by evaluating a parse tree object

430 5,689,633 Computer program product and program storage device for including stored procedure user defined function or trigger processing within a unit of work

431 5,687,362 Enumerating projections in SQL queries containing outer and full outer joins in the presence of inner joins

432 5,680,603 Method and apparatus for reordering complex SQL queries containing inner and outer join operations

433 5,680,602 Trigger generation in an active database management system

434 5,675,804 System and method for enabling a compiled computer program to invoke an interpretive computer program

435 5,673,319 Block cipher mode of operation for secure, length-preserving encryption

436 5,668,988 Method for mining path traversal patterns in a web environment by converting an original log sequence into a set of traversal sub-sequences

437 5,668,718 Generating growth alternatives

438 5,666,435 System for analysis of x-ray films of nucleotide sequences

439 5,664,183 Application of groupware to ISO 9000 registration via facilitated work sessions

440 5,664,174 System and method for discovering similar time sequences in databases

441 5,663,890 Method, apparatus and computer program product for determining a frequency domain response of a nonlinear microelectronic circuit

442 5,661,807 Authentication system using one-time passwords

443 5,659,727 Computer program product and program storage device for encoding, storing, and retrieving hierarchical data processing information for a computer system

444 5,659,492 Chemical mechanical polishing endpoint process control

445 5,657,447 Platform-transparent registration and build of stored procedures and user-defined functions

446 5,655,107 Digital logic wire delay simulation

447 5,652,917 System for transmitting and receiving combination of compressed digital information and embedded strobe bit between computer and external device through parallel printer port of computer

448 5,652,899 Software understanding aid for generating and displaying simiplified code flow paths with respect to target code statements

449 5,652,829 Feature merit generator

450 5,651,069 Software-efficient message authentication

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	PAT. NO.	Title
451	5,648,648	Personal identification system for use with fingerprint data in secured transactions
452	5,646,956	System and method for estimating top contributors
453	5,646,509	Battery capacity test and electronic system utilizing same
454	5,644,751	Distributed file system (DFS) cache management based on file access characteristics
455	5,640,561	Computerized method and system for replicating a database using log records
456	5,640,559	System and method of encoding units of data including entity/relationship data, function calls and file data using a common format (CDF) according to formal CDF grammar rules
457	5,640,500	Computer program product for enabling a computer to construct displays of partially ordered data
458	5,640,487	Building scalable n-gram language models using maximum likelihood maximum entropy n-gram models
459	5,640,014	Laser diode spectrometer for analyzing the ratio of isotopic species in a substance
460	5,636,291	Continuous parameter hidden Markov model approach to automatic handwriting recognition
461	5,636,144	Evaluation and ranking of manufacturing line non-numeric information
462	5,635,931	System and method for compressing data information
463	5,634,002	Method and system for testing graphical user interface programs
464	5,633,734	Method and apparatus for modifying a fluorescent portion of a digital image

465 5,632,015 Computer program product to efficiently process diverse result sets returned by a stored procedure

466 5,629,695 Order preserving run length encoding with compression codeword extraction for comparisons

467 5,628,006 Computer program product and program storage device for merging and separating attributes of consoles

468 5,623,676 Computer program product and program storage device for safing asynchronous interrupts

469 5,621,809 Computer program product for automatic recognition of a consistent message using multiple complimentary sources of information

470 5,621,665 Selecting levels for factors for industrial process experiments

471 5,615,373 Data lock management in a distributed file server system determines variable lock lifetime in response to request to access data object

472 5,615,361 Exploitation of uniqueness properties using a 1-tuple condition for the optimization of SQL queries

473 5,615,341 System and method for mining generalized association rules in databases

474 5,615,284 Stylus-input recognition correction manager computer program product

475 5,615,213 Message transmission using out-of-band signaling channel

476 5,612,700 System for extracting targets from radar signatures

477 5,606,700 Computer program product and program storage device for object oriented programming platform

478 5,600,832 Variant domains and variant maps in a versioned database management system

479 5,590,324 Optimization of SQL queries using universal quantifiers, set intersection, and max/min aggregation in the presence of nullable columns

480 5,590,322 Method and apparatus for the modeling and query of database structures using natural language-like constructs

481 5,590,321 Push down optimization in a distributed, multi-database system

482 5,588,110 Method for transferring data between two devices that insures data recovery in the event of a fault

483 5,581,795 System for transmitting and receiving digital information through parallel printer port of computer by using embedding strobe bit in eight bit data of printer port

484 5,581,758 Computer program product for object specification, generation, and management in a distributed database

485 5,564,113 Computer program product for rendering relational database management system differences transparent

486 5,564,050 System and method for enabling an interpreted programming language to be executed in a database management system environment

487 5,564,047 Trigger generation in an active database management system

488 5,564,019 Program storage device and computer program product for managing a shared direct access storage device with a fixed block architecture

489 5,561,803 Computer program product and program storage device for incremental processing of computer objects

490 5,561,798 Computer program product and program storage device for improving data recovery performance

491 5,559,949 Computer program product and program storage device for linking and presenting movies with their underlying source information

492 5,559,707 Computer aided routing system

493 5,551,031 Program storage device and computer program product for outer join operations using responsibility regions assigned to inner tables in a relational database

494 5,548,758 Optimization of SQL queries using early-out join transformations of column-bound relational tables

495 5,548,755 System for optimizing correlated SQL queries in a relational database using magic decorrelation

496 5,548,754 Optimization of SQL queries using early-out join transformations

497 5,546,570 Evaluation strategy for execution of SQL queries involving recursion and table queues

498 5,543,621 Laser diode spectrometer for analyzing the ratio of isotopic species in a substance

499 5,542,071 System for determining communication speed of parallel printer port of computer by using start timer and stop timer commands within data combined with embedded strobe

500 5,535,131 System for analyzing sound quality in automobile using musical intervals

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	PAT. NO.	Title
501	5,528,260	Method and apparatus for proportional auto-scrolling
502	5,513,214	System and method of estimating equalizer performance in the presence of channel mismatch
503	5,437,023	Noise-tolerant address transmission system for digital telecommunication network
504	5,307,262	Patient data quality review method and system
505	5,179,579	Radiograph display system with anatomical icon for selecting digitized stored images
506	5,005,137	Method for optimizing data streams containing two-byte characters

US005860929A

United States Patent [19]

Rubin et al.

[11] Patent Number: 5,860,929

[45] Date of Patent: Jan. 19, 1999

[54] **FRACTIONAL MOVING BLOOD VOLUME ESTIMATION WITH POWER DOPPLER ULTRASOUND**

[75] Inventors: **Jonathan M. Rubin; Ronald S. Adler; J. Brian Fowlkes**, all of Ann Arbor, Mich.; **Ray Steven Spratt**, San Jose, Calif.

[73] Assignee: **The Regents of the University of Michigan**, Ann Arbor, Mich.

[21] Appl. No.: **657,897**

[22] Filed: **Jun. 7, 1996**

[51] **Int. Cl.**[6] **A61B 8/06**

[52] **U.S. Cl.** **600/454**

[58] **Field of Search** 128/661.07–661.1, 128/916; 73/861.25; 600/454–458

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5,474,073	12/1995	Schwartz et al.	128/661.1

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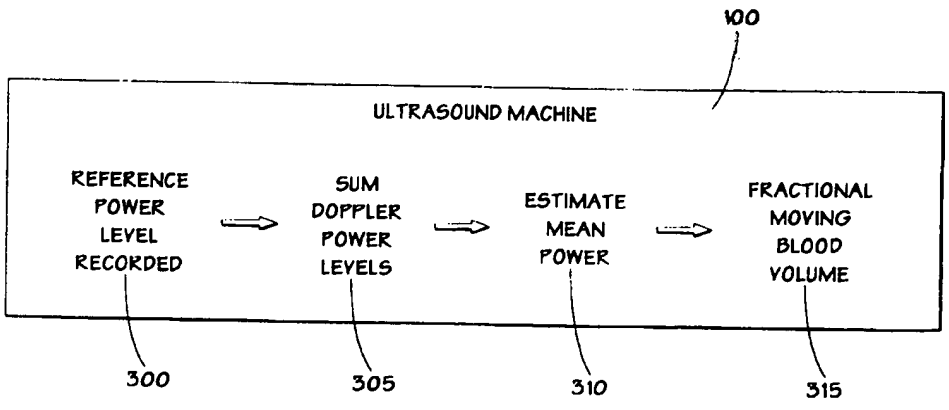
[57] **ABSTRACT**

A method for quantitatively estimating the amount of tissue that contains moving blood using power Doppler ultrasound. A region of interest is identified from a frozen image (i.e., a snapshot screen display created by displaying the last real-time image for a given scan). The region of interest is specified by using a pointing device (e.g., a mouse). An object that contains one hundred percent blood flow and is located at the same depth as the region of interest, but not necessarily inside the region of interest, is identified and the corresponding power noted and designated as the reference power level. The display is adjusted to show the one hundred percent blood flow vessel in a designated color (such as, for example, green) and all other power levels are normalized to the reference power level. The fractional blood volume is quantitatively estimated by summing the normalized Doppler power levels in a region of interest and dividing the sum by the number of pixels in region of interest. The numerical result for the specified region of interest may be shown on the display of the ultrasound scanner.

20 Claims, 3 Drawing Sheets



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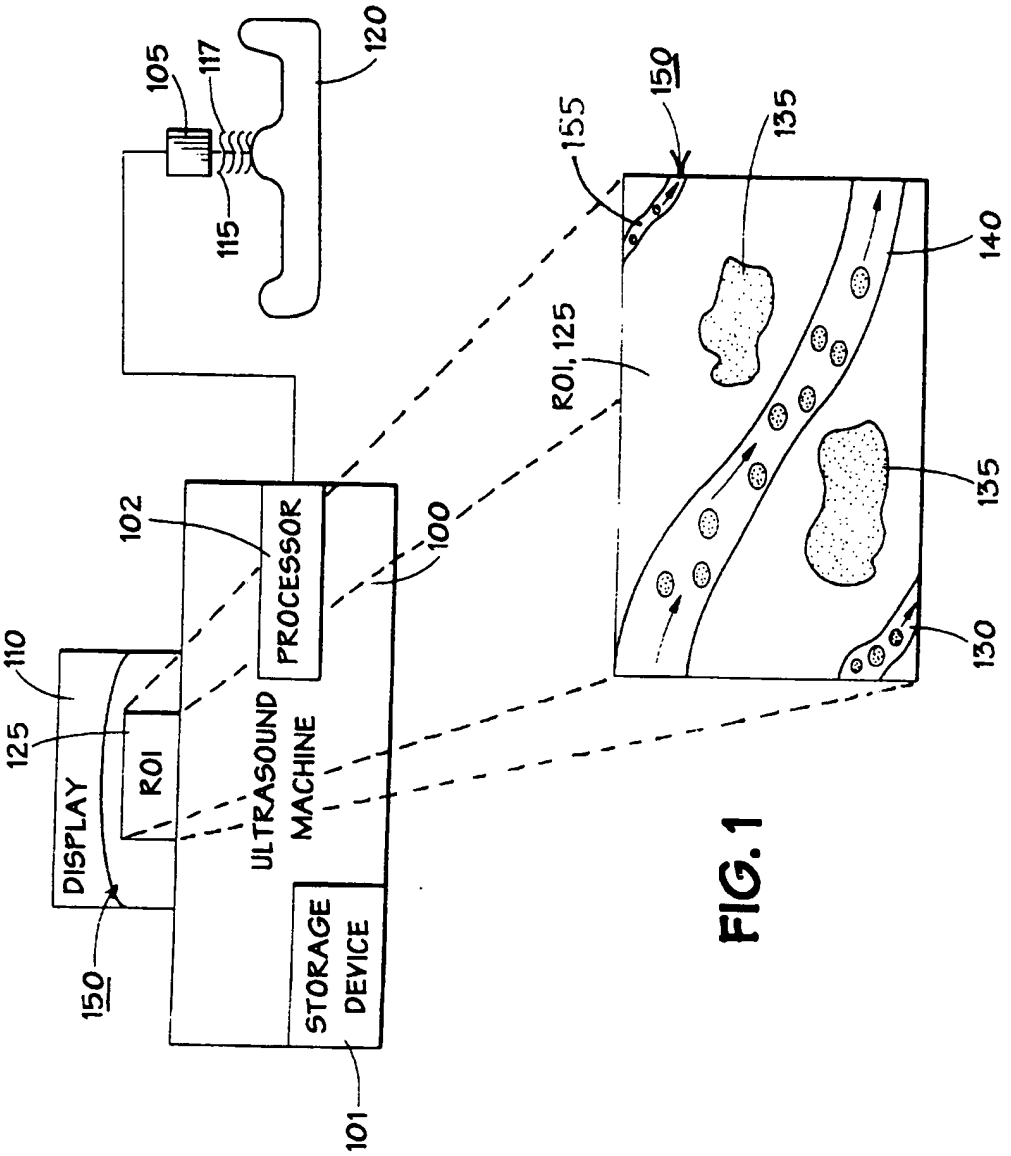
105
117
120
115
150
155
135
140
ROI, 125
135
130
102
PROCESSOR
100
110
125
DISPLAY
ROI
ULTRASOUND MACHINE
STORAGE DEVICE
150
101

FIG. 1

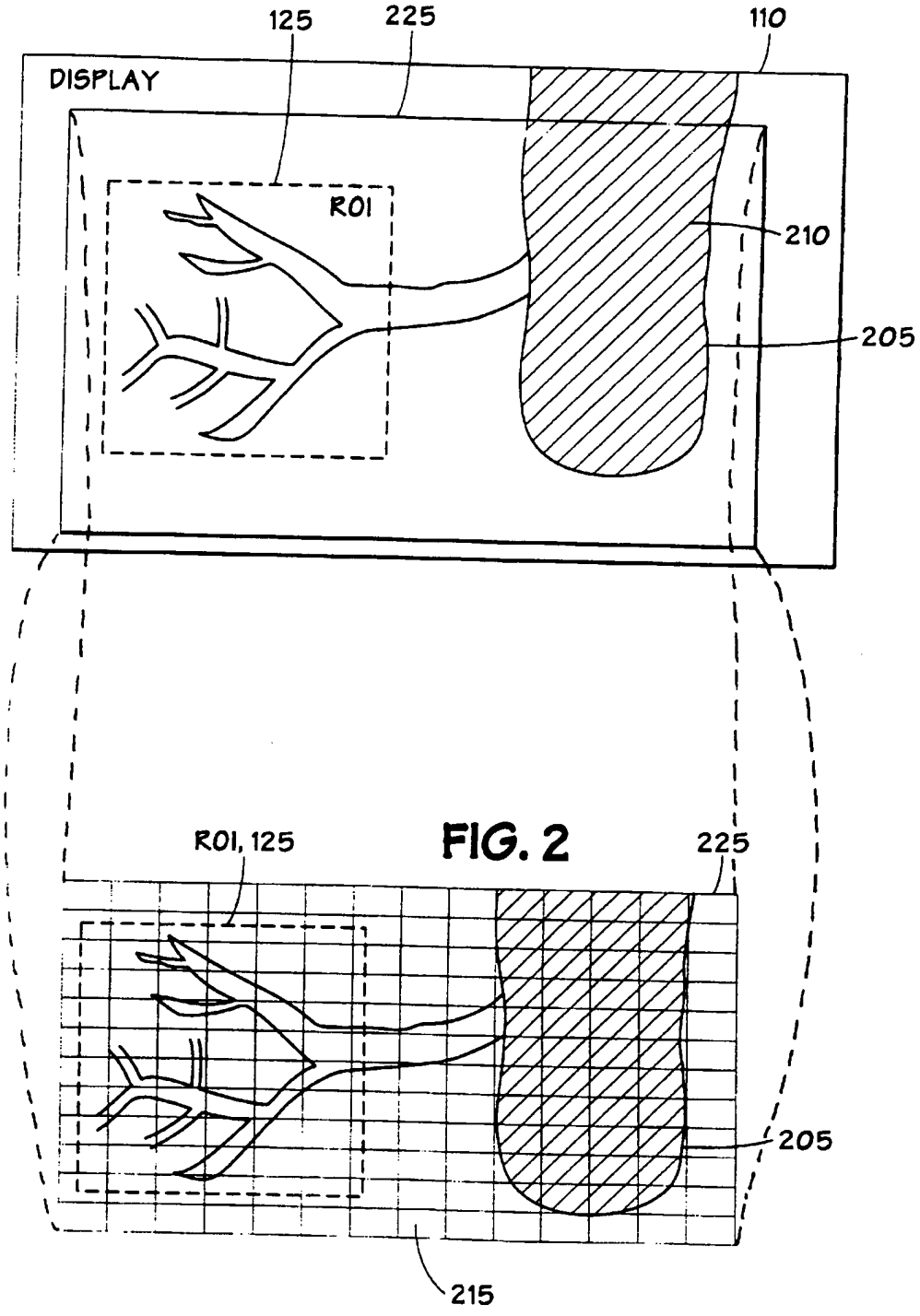

FIG. 2

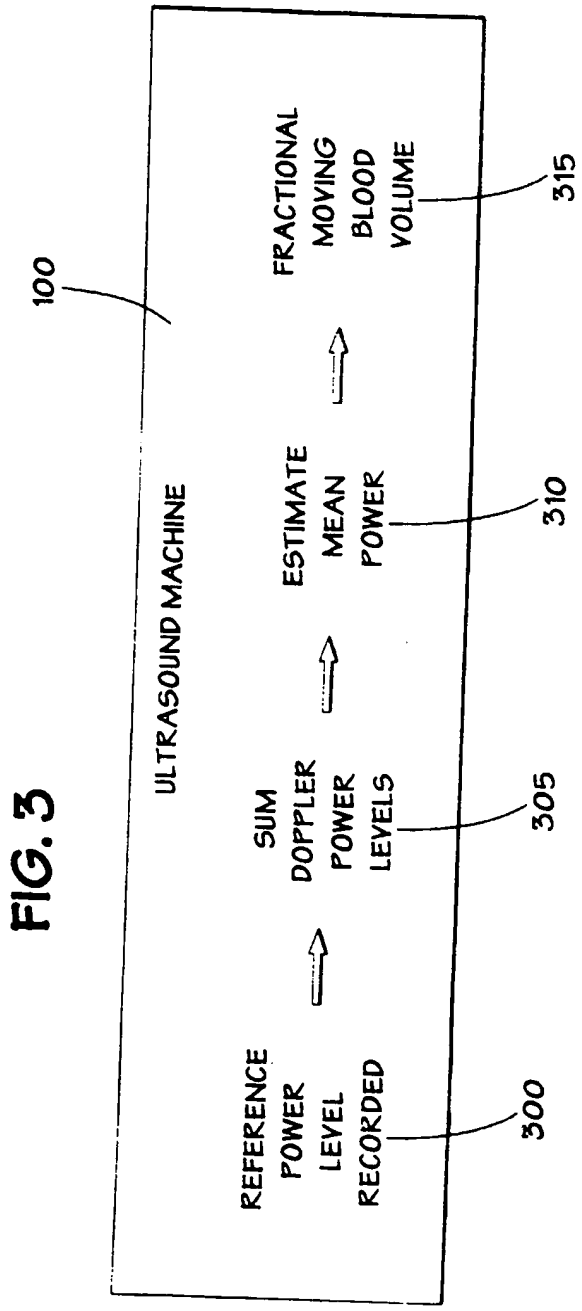
100
ULTRASOUND MACHINE
REFERENCE POWER LEVEL RECORDED
300
SUM DOPPLER POWER LEVELS
305
ESTIMATE MEAN POWER
310
FRACTIONAL MOVING BLOOD VOLUME
315

FIG. 3

FRACTIONAL MOVING BLOOD VOLUME ESTIMATION WITH POWER DOPPLER UETRASOUND

The U.S. Government may have rights in this invention as provided by the terms of Grant Number ROI CA55076 awarded by the U.S. Public Health Service.

FIELD OF THE INVENTION

The invention relates in general to the field of medicine, and more particularly, to the use of power Doppler ultrasound in medical imaging. Specifically, the invention relates to methods of measuring the amount of moving blood in tissue in a region of interest.

BACKGROUND OF THE INVENTION

In the diagnosis of various medical conditions, it is often useful to examine soft tissues and/or blood flow within the body to show structural details of organs and blood vessels in these organs. Multiple studies have demonstrated increased vascularity (blood flow) in many tumors relative to that of normal tissue, and multiple attempts have been made to depict these differences in vascularity using ultrasonic imaging.

As well-known to those of ordinary skill, a standard real-time two-dimensional (2D) ultrasound scan typically entails the following. Referring to FIG. 1, an operator holds a transducer **105** in one position relative to a volume of material, e.g., human tissue in a patient **120**. The transducer **105** is sometimes referred to as a scan head; it commonly has an essentially linear, one-dimensional (1D) shape, although scan heads of round or other shapes are also known, and emits a beam of ultrasound energy toward the material in a patient **120**. The ultrasound energy is reflected from the material and detected by the scan head **105**, which generates data signals representative of the detected energy.

A conventional ultrasound machine **100**, operating under the control of a processor **102** such as a microprocessor, receives and processes the resulting data from the scan head **105**. The processor **102** typically reads program instruction statements and/or data from a program storage device **101** such as read-only memory (ROM). The ultrasound machine **100** displays a 2D image of the tissue volume being scanned, e.g., on a video display terminal **110**, a film camera, or other hard copy device (not shown). Movement of the scan head **105** results in different 2D views of the tissue volume being presented.

Additional background information can be found in, e.g., Fractional Moving Blood Volume: Estimation with Power Doppler US, at pages 183 et seq. of the October 1995 edition of RADIOLOGY, which is incorporated herein by reference, and in the references cited therein.

SUMMARY OF INVENTION

The invention describes a method for quantitatively estimating the amount of moving blood a tissue contains (fractional moving blood volume) for a given region of interest (ROI) using power Doppler ultrasound. A region of interest is identified from a frozen image (i.e., a snapshot screen display created by displaying the last real-time image for a given scan). The region of interest is specified by using a pointing device (e.g., a mouse). An object that contains one hundred percent blood flow, e.g., a blood vessel, and is located at the same depth as the region of interest, but not necessarily inside the region of interest, is identified and the corresponding power designated as the reference power level. The display is adjusted to show the vessel having one hundred percent blood flow in a designated color (such as, for example, green) and all other power levels are normalized to the reference power level. The fractional blood volume is quantitatively estimated by summing the normalized Doppler power levels and dividing the sum by the number of pixels inside the region of interest.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 illustrates the objects involved in acquiring a power Doppler image of targeted tissue.

FIG. 2 illustrates specification of a region of interest and an associated reference vessel.

FIG. 3 is a flow chart that illustrates the actions performed by the ultrasound machine to generate an estimate of the fractional moving blood volume.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

Illustrative embodiments of the invention are described below as it might be employed in the method of quantitatively estimating the fractional moving blood volume estimation with power Doppler ultrasound. In the interest of clarity, not all features of an actual implementation are described in this specification. It will, of course, be appreciated that in the development of any such actual embodiment numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill having the benefit of this disclosure.

Overview

FIG. 1 illustrates an schematic diagram of objects involved in acquiring a power Doppler ultrasound. The ultrasound machine **100** (e.g., a Spectra VST Scanner) contains both a display **110** and a scanning head **105**. The scanning head may be movable to enable various regions of the scanning subject **120** to be imaged. The scanner **100** emits ultrasound signals (incident signals) **115** which are incident upon the scanning subject **120**. Due to the variation of densities within the subject **120**, the incoming signals **115** may become reflected signals **117**, or echoes. The frequency differences between the incident signals **115** and the echoes **117** are analyzed by the ultrasound machine **100** to create an image **150**.

Within an image **150**, a region of interest (ROI) **125** may be designated. This region of interest **125** may contain several types of hard tissues (i.e., tissues in which no blood flows) **135**. A region of interest **125** may also contain tissues through which varying amounts of blood flow like **130**, **140** and **155**. The invention provides a quantitative estimate for the amount of moving blood in tissue within the region of interest **125**.

Specific Embodiments

FIG. 2 shows an enlargement of a display **110** and a window **225** which is divided into squares or pixels **215**. Since a region of interest **125** may contain multiple pixels **215**, a summation may need to be performed to provide a quantitative answer. Ultrasound is attenuated with depth and

therefore quantitative measurements made with ultrasound should be depth normalized. A reference vessel **205** containing 100 percent moving blood (e.g., a blood vessel) at the depth of the region of interest **125** may be used for normalization purposes. Normalization may be done on the display **110** by adjusting a color knob until the reference vessel **205** is approximately seventy five percent filled with a specified color **210** (e.g., green) and noting the corresponding power level (reference power level) which results in acceptable and nearly correct answers. If the depiction of the reference vessel **205** is less than about seventy five percent filled, the fractional moving blood volume is likely to be underestimated while completely filling the depiction of the reference vessel tends to overestimate the fractional moving blood volume. Hence, the judgment of the operator should be used to ensure proper normalization. This is colloquially referred to as "setting a green tag level." Any pixel value with a power level greater than the reference power level is set to the reference power level which ensures that the estimate of the fractional moving blood volume is never greater than one. Those of ordinary skill in the art will recognize that though the reference vessel **205** needs to be at the same depth in the tissue it need not necessarily be inside the region of interest **125**. It will also be apparent to those of ordinary skill in the art having the benefit of this disclosure that an ultrasound contrast agent may be used instead of a reference vessel that contains a hundred percent moving blood to estimate the fractional moving blood volume.

FIG. **3** illustrates the operations performed by the scanner once the reference power level (power level associated with the reference vessel) has been recorded at **300**. Since each pixel **215** has a color associated with it and thus an associated power also, at **305** all of the power levels for each pixel **215** in the region of interest **125** are summed to yield the total power for the region of interest. At **310**, an estimate of the mean power is calculated by dividing the total power for the region of interest by the number of pixels in the region of interest. A fractional moving blood volume for a given depth may be estimated at **315** by dividing the mean power estimate by the reference power level. The value of the fractional moving blood volume may then be shown on the display **110** or utilized in other calculations. It will be apparent to those of ordinary skill in the art having the benefit of this disclosure that a series of summations for a given region of interest may be used to yield a corresponding estimate of the fractional moving blood volume for any location in the subject **120**.

Program Storage Device

Any of the foregoing variations may be implemented by programming a suitable ultrasound machine having an appropriate processor or processors **102**. The programming may be accomplished through the use of a program storage device readable by the processor encoding a program of instructions executable by the machine for performing the operations described above. The program storage device may take the form of, e.g., one or more floppy disks; a CD ROM or other optical disk; a magnetic tape; a read-only memory chip (ROM); and other forms of the kind well-known in the art or subsequently developed. The program of instructions may be "object code," i.e., in binary form that is executable more-or-less directly by the computer; in "source code" that requires compilation or interpretation before execution; or in some intermediate form such as partially compiled code. The precise forms of the program storage device and of the encoding of instructions is immaterial here.

It will be appreciated by those of ordinary skill in the art having the benefit of this disclosure that numerous variations from the foregoing illustration will be possible without departing from the inventive concept described therein. Accordingly, it is the claims set forth below, and not merely the foregoing illustration, which are intended to define the exclusive rights claimed in this application.

What is claimed is:

1. A method of quantifying fractional moving blood volume in a tissue volume, said method comprising:

(a) receiving a signal encoding a power Doppler scan of the tissue volume, said signal including a plurality of samples;

(b) designating a region of interest at a selected depth within the tissue volume, said region of interest corresponding to a target portion of the signal;

(c) identifying, in a reference portion of the signal received from a depth within the tissue volume substantially similar to the selected depth, a reference Doppler power level associated with 100% flow;

(d) computing a mean power estimate by averaging respective target Doppler power levels of the samples in the target portion; and

(e) computing a fractional moving blood volume estimate by normalizing the mean power estimate to the reference Doppler power level.

2. The method of claim **1**, further including generating a visual display of the fractional moving blood volume estimate.

3. A method of quantifying fractional moving blood volume in a tissue volume, said method comprising:

(a) performing a power Doppler scan of the tissue volume to generate an image of the tissue volume, said image including a plurality of pixels;

(b) designating a region of interest at a selected depth within the tissue volume, said region of interest corresponding to a target portion of the image;

(c) identifying, in a reference portion of the image received from a depth within the tissue volume substantially similar to the selected depth, a reference Doppler power level associated with 100% flow;

(d) computing a mean power estimate equal to the sum of respective target Doppler power levels of pixels within the target portion divided by the number of said pixels within the target portion;

(e) computing a fractional moving blood volume estimate by normalizing the mean power to the reference Doppler power level; and

(f) generating a visual display of the fractional moving blood volume estimate.

4. The method of claim **3**, wherein said target portion and said reference portion are disjoint sets of said plurality of pixels of said image, said disjoint sets having no common pixels common to both said target portion and said reference portion.

5. The method of claim **3**, wherein said target portion and said reference portion include an overlapping portion of said image, said overlapping portion having at least one common pixel common to both said target portion and said reference portion.

6. The method of claim **5**, wherein said overlapping portion of said image has a plurality of common pixels common to both said target portion and said reference portion.

7. The method of claim **6**, wherein said plurality of common pixels includes substantially all of the pixels in said target portion.

8. The method of claim 6, wherein said plurality of common pixels includes substantially all of the pixels in said reference portion.

9. The method of claim 6, wherein said plurality of common pixels includes substantially all of the pixels in said target portion and in said reference portion.

10. An ultrasound machine comprising a signal input adapted to be coupled to an ultrasound scan head; a processor coupled to receive signals from the signal input; and a program storage device readable by the processor, tangibly embodying a program of instructions executable by the processor to perform the method of a specified one of claims 1 through 3.

11. A program storage device readable by a processor in an ultrasound machine, tangibly embodying a program of instructions executable by the processor to perform the method of a specified one of claims 1 through 3.

12. The method of claim 1, wherein said target portion and said reference portion are disjoint sets of said plurality of samples of said signal, said disjoint sets having no common samples common to both said target portion and said reference portion.

13. The method of claim 1, wherein said target portion and said reference portion include an overlapping portion of said signal, said overlapping portion having at least one common sample common to both said target portion and said reference portion.

14. The method of claim 13, wherein said overlapping portion of said signal has a plurality of common samples common to both said target portion and said reference portion.

15. The method of claim 14, wherein said plurality of common samples includes substantially all of the samples in said target portion.

16. The method of claim 14, wherein said plurality of common samples includes substantially all of the samples in said reference portion.

17. The method of claim 14, wherein said plurality of common samples includes substantially all of the samples in said target portion and in said reference portion.

18. The method of claim 1, wherein said reference Doppler power level associated with 100% flow is associated with a reference blood vessel having 100% flow and said fractional moving blood volume estimate is depth normalized to said selected depth.

19. The ultrasound machine of claim 10, wherein said program of instructions includes instructions for performing one of the method of claim 1 and a first specified one of claims 12 through 18, the method of claim 2 and a second specified one of claims 12 through 18, and the method of claim 3 and a third specified one of claims 14 through 9.

20. The program storage device of claim 11, wherein said program of instructions includes instructions for performing one of the method of claim 1 and a first specified one of claims 12 through 18, the method of claim 2 and a second specified one of claims 12 through 18, and the method of claim 3 and a third specified one of claims 4 through 9.

* * * * *